



ANALYSIS OF DISCOVERY LEARNING TEACHING MODEL IN FOSTERING STUDENTS CRITICAL THINKING SKILLS IN MATHEMATICS LEARNING CLASS IV SDN 1 KOLELET WETAN

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Abstract

Critical thinking ability is an essential 21st-century competency that elementary school students must possess to navigate complex problem-solving in mathematics learning. This study aims to analyze the application of the Discovery Learning model in fostering grade IV students' critical thinking skills on the topic of curved side space figures. The research employs a qualitative descriptive method. The research sample comprised grade IV students at SDN 1 Kolelet Wetan, selected using a purposive sampling technique. Data collection techniques were carried out through semi-structured interviews, classroom observations, and student report documentation. Data were analyzed through qualitative analysis techniques consisting of data reduction, data display, and conclusion drawing. The results show that implementing the Discovery Learning model enables students to think independently, deduce mathematical concepts on their own, and answer questions confidently without prior direct explanation from the teacher. It can be concluded that the Discovery Learning model serves as an effective pedagogical approach to enhance students' critical thinking, self-reliance, and conceptual mastery in primary mathematics education.

Keyword:

Discovery Learning, Critical Thinking Skills, Mathematics Learning

INTRODUCTION

Education plays an important role in developing the quality of human resources through the development of students' knowledge, skills, attitudes, and thinking abilities (Zikrulloh et al., 2025). One of the essential 21st-century abilities that needs to be developed from elementary school is critical thinking, which refers to students' ability to identify problems, analyze information, provide logical reasoning, evaluate, and draw conclusions (Hidayati et al., 2024; Sipayung et al., 2025). These abilities are highly relevant to mathematics learning because mathematics requires not only computational skills but also conceptual understanding, reasoning, and problem-solving (Adha et al., 2024; Suparlan, 2021). One topic that requires these abilities is curved-surface solids, including cylinders, cones, and spheres, which require students to understand their elements, relationships between concepts, surface area, volume, and their applications in everyday life (Maharani et al., 2022).

However, field observations and prior studies indicate that learning about curved-surface solids is often still oriented toward providing formulas and practicing routine problems, causing students to tend to memorize procedures without understanding how the concepts are formed (Melinia et al., 2022; Sampe et al., 2023). According to Ansya et al. (2024), teacher-centered approaches and monotonous learning media reduce students' interest and passive engagement, which ultimately hinders the development of higher-order cognitive faculties. Such passive conditions limit opportunities for students to explore, analyze, provide reasoning, and independently develop problem-solving strategies (Agnesya & Wiarsih, 2025; Rahman, 2021). Consequently, when faced with non-routine contextual

problems regarding curved-surface solids, elementary students frequently experience difficulties in transferring basic concepts into critical analytical steps (Ihwan et al., 2023).

One pedagogical model that can be implemented to address this issue is Discovery Learning. This model provides students with opportunities to discover concepts through structured phases, including stimulation, problem identification, information gathering, data processing, verification, and conclusion drawing (Hosnan, 2017; Yuliana, 2018). As explained by Islamiyah et al. (2022), active and inductive learning models empower students to reconstruct their own knowledge base through guided investigation. Furthermore, Tanjung et al. (2019) emphasize that discovery-based learning environments cultivate student autonomy, self-reliance, and intellectual confidence when tackling mathematical tasks. These steps are directly aligned with critical thinking indicators because students are required to analyze information, weigh evidence, construct logical arguments, and draw valid conclusions independently (Anisa, 2018; Astuti et al., 2019).

Although previous studies have demonstrated the potential of Discovery Learning to improve general learning outcomes and conceptual understanding (Ayuni et al., 2026; Rohmah et al., 2025), there remains a distinct research gap regarding how each specific phase of Discovery Learning explicitly fosters critical thinking skills within the specific domain of curved-surface solids in primary education. Most existing literature focuses predominantly on quantitative performance scores or final test achievement (Ayu et al., 2026; Sumanty, 2020), while the qualitative process of how elementary students process mathematical information, verify geometrical properties, evaluate problem-solving strategies, and formulate conclusions has not been deeply explored. Therefore, this study offers a novel contribution by examining the qualitative synergy between the sequential stages of Discovery Learning, the geometric characteristics of curved-surface solids, and elementary students' critical thinking development.

Based on these background conditions, the core research problem focuses on how the implementation of Discovery Learning provides meaningful learning experiences that encourage elementary students not only to memorize formulas for curved-surface solids, but also to construct geometric concepts through discovery and develop critical thinking skills. Correspondingly, this study aims to describe and analyze the implementation of the Discovery Learning model on the topic of curved-surface solids, while critically analyzing the progression of students' critical thinking skills across each stage of the learning process. The findings are expected to contribute both theoretically and practically to the development of elementary mathematics instruction that is active, contextual, meaningful, and explicitly oriented toward fostering 21st-century critical thinking skills.

METHODOLOGY

This study employs a qualitative approach with an analytical descriptive design (Moleong, 2017). This design aims to observe and describe in depth the naturalistic process of mathematics instruction, specifically the activities of the teacher and students across every phase of the Discovery Learning model—including stimulation, problem statement, data collection, data processing, verification, and generalization—on the topic of curved-surface solids. A qualitative approach was selected because the primary research focus is on understanding the students' learning process and experiences holistically, rather than testing statistical relationships between variables (Sugiyono, 2018).

The research subjects comprised the fourth-grade teacher and students at SDN 1 KOLELET WETAN, Rangkasbitung, Lebak Regency, Banten Province. Subject selection was conducted using a purposive sampling technique based on the direct involvement of the teacher and students in mathematics learning regarding curved-surface solids. Research data included primary data collected directly through classroom observations and interviews, as well as secondary data gathered from instructional documents such as teaching modules, instructional materials, student worksheets (LKPD), student work portfolios, and relevant activity documentation.

Data collection was carried out comprehensively through four primary techniques based on Miles et al. (2014): direct observation, semi-structured interviews, field notes, and documentation. Observation was used to directly monitor teacher and student activities during the discovery process, particularly focusing on critical thinking indicators such as problem identification, data processing,

logical reasoning, and conclusion drawing. Semi-structured interviews were conducted with the teacher and selected students to gain deeper insights into their experiences, challenges, and responses to Discovery Learning. Meanwhile, field notes recorded spontaneous critical events during lessons, and documentation gathered physical evidence including lesson plans and student work outputs.

Data analysis and research procedures were executed interactively through data collection, data reduction, data display, and conclusion drawing/verification (Miles et al., 2014). Raw data from various sources were first gathered and then reduced by filtering relevant information and categorizing it according to the stages of Discovery Learning and critical thinking indicators. Categorized data were presented in descriptive narrative form and analytical matrices, leading to verified final conclusions. To establish data trustworthiness, the study employed both source triangulation (comparing teacher and student perspectives) and technical triangulation (cross-verifying observation, interview, field note, and documentation data), along with prolonged engagement to meet criteria for credibility, dependability, and confirmability (Sugiyono, 2018).

RESULTS AND DISCUSSION

The results of the study indicate that the implementation of the *Discovery Learning* model in Grade IV Mathematics at SDN 1 Kolelet Wetan was carried out through several activities, including providing stimuli, identifying problems, observing, collecting and processing information, verifying findings, and drawing conclusions on the topic of curved-surface solid geometry. The teacher began the lesson with a prayer, an introductory activity, and a review of the previous material. The teacher then introduced the topic of curved-surface solids and presented examples of cylindrical, conical, and spherical objects commonly found in everyday life.

Based on observations, interviews, and documentation, students were actively involved in the learning activities through observing objects representing curved-surface solids, participating in group discussions, identifying the elements of solid figures, and solving the problems provided. Some students were able to identify the shapes, surfaces, edges, vertices, and characteristics of curved-surface solids and communicate their observations through group discussions.

The findings indicate several activities related to students critical thinking skills, particularly in identifying problems, analyzing information, providing reasons, solving problems, and drawing conclusions. Students were given opportunities to discover the concepts of curved-surface solids through observation and problem-solving activities without receiving all of the concepts directly from the teacher. Students were also able to solve several problems independently and formulate conclusions based on the learning activities.

Figure 1. The Implementation of *Discovery Learning*



The implementation of *Discovery Learning* positioned the teacher as a facilitator who provided stimuli in the form of concrete objects or mathematical problems, guided students in identifying and discovering concepts, posed guiding questions, and conducted learning evaluations. Meanwhile, students actively participated in observing, collecting information, discussing, verifying findings, solving problems, and drawing conclusions about curved-surface solids. This study has several limitations, as it was conducted in only one school and one class and focused on the topic of curved-surface solids. Therefore, the findings reflect the conditions within the specific research context. Students' critical thinking skills were assessed through observations, interviews, and documentation without using quantitative measurements. Future research could involve a larger number of schools and employ a mixed-method approach to obtain a broader understanding of the implementation of *Discovery Learning* in fostering students' critical thinking skills in Mathematics learning.

CONCLUSION

The Discovery Learning model is an effective pedagogical framework that provides students with structured opportunities to independently discover mathematical concepts rather than passively receiving direct instruction. In the context of primary mathematics learning—specifically on the topic of curved-surface solids including cylinders, cones, and spheres—the model engages students in systematic exploration through observation, problem identification, data processing, and concept verification. Through these inductive activities, students construct their own conceptual understanding of geometric properties, demonstrate independence in problem-solving, and develop key 21st-century critical thinking indicators, such as analytical reasoning, logical argumentation, and evidence-based conclusion drawing.

The findings of this study have important theoretical and practical implications for primary mathematics education. Theoretically, this research reinforces constructivist learning theories by demonstrating that young learners can develop higher-order critical thinking skills when guided through structured discovery rather than rote formula memorization. Practically, it highlights the value of shifting teacher roles from primary information providers to learning facilitators who scaffold inquiry. Based on these insights, it is recommended that elementary school teachers integrate the Discovery Learning model more broadly across abstract spatial topics by designing contextually rich, manipulative-based worksheets (LKPD). For future research, it is recommended to expand the scope through mixed-methods or quantitative experimental designs with larger sample sizes to evaluate the long-term impact of Discovery Learning on mathematical retention and critical thinking skills across diverse school environments.

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